8. To determine how long it took for the temperature to reach –12.5°C, divide: (–12.5) ÷ (–2.5) = 5
It took 5 h for the temperature to reach –12.5°C.

9. **a)** 20.736 ÷ (–1.8) = –11.52

b) (–27.94) ÷ 1.2 = $-23.28\overline{3}$

c) (–84.41) ÷ (–2.3) = 36.7

d) 23.04 ÷ 4.8 = 4.8

e) 76.63 ÷ (–7.5) = $-10.21\overline{73}$

f) (–0.1081) ÷ 0.45 = $-0.240\overline{2}$

11. a) (–1450.50) ÷ (–30.75) ≐ 47.17; it will take 48 weeks for Paige to pay her parents back.

b) Debt is represented by a negative number. So, the amount in dollars Paige borrowed is represented by –1450.50. When Paige pays back her parents, she is spending money, so the amount in dollars she pays back is also represented by a negative number: –30.75

12. a) $\frac{5}{4} \div \left(-\frac{7}{6}\right)$

Use the strategy of multiplying by the reciprocal of the divisor.

$$\frac{5}{4} \div \left(-\frac{7}{6}\right) = \frac{5}{2\cancel{4}} \times \left(-\frac{\cancel{6}^{3}}{7}\right)$$
$$= \frac{5 \times (-3)}{2 \times 7}$$
$$= -\frac{15}{14}, \text{ or } -1\frac{1}{14}$$

b) $\frac{3}{10} \div \frac{12}{5}$

Use the strategy of multiplying by the reciprocal of the divisor.

$$\frac{3}{10} \div \frac{12}{5} = \frac{{}^{1}\cancel{3}}{{}^{2}\cancel{10}} \times \frac{\cancel{5}^{1}}{\cancel{12}^{4}}$$
$$= \frac{1}{8}$$

c) $\left(-\frac{3}{4}\right) \div \left(-1\frac{1}{8}\right)$

Write the mixed number as an improper fraction.

$$\left(-\frac{3}{4}\right) \div \left(-1\frac{1}{8}\right) = \left(-\frac{3}{4}\right) \div \left(-\frac{9}{8}\right)$$

Use the strategy of dividing fractions with a common denominator.

$$\left(-\frac{3}{4}\right) \div \left(-\frac{9}{8}\right) = \left(-\frac{6}{8}\right) \div \left(-\frac{9}{8}\right)$$
$$= \frac{6}{9}, \text{ or } \frac{2}{3}$$

d) $\left(-4\frac{3}{5}\right) \div \frac{3}{4}$

Write the mixed number as an improper fraction.

$$\left(-4\frac{3}{5}\right) \div \frac{3}{4} = \left(-\frac{23}{5}\right) \div \frac{3}{4}$$

Use the strategy of dividing fractions with a common denominator.

$$\left(-\frac{23}{5}\right) \div \frac{3}{4} = \left(-\frac{92}{20}\right) \div \frac{15}{20}$$
$$= -\frac{92}{15}, \text{ or } -6\frac{2}{15}$$

e) $3\frac{2}{3} \div \left(-2\frac{1}{4}\right)$

Write the mixed numbers as improper fractions.

$$3\frac{2}{3} \div \left(-2\frac{1}{4}\right) = \frac{11}{3} \div \left(-\frac{9}{4}\right)$$

Use the strategy of multiplying by the reciprocal of the divisor.

$$\frac{11}{3} \div \left(-\frac{9}{4}\right) = \frac{11}{3} \times \left(-\frac{4}{9}\right)$$
$$= -\frac{44}{27}, \text{ or } -1\frac{17}{27}$$

f) $3\frac{4}{9} \div 6\frac{1}{3}$

Write the mixed numbers as improper fractions.

$$3\frac{4}{9} \div 6\frac{1}{3} = \frac{31}{9} \div \frac{19}{3}$$

Use the strategy of multiplying by the reciprocal of the divisor.

$$\frac{31}{9} \div \frac{19}{3} = \frac{31}{{}^{3}\cancel{9}} \times \frac{\cancel{3}}{19}$$
$$= \frac{31}{57}$$

13. The difference between 5°C and –5.5°C is: 5°C – (–5.5°C) = 10.5°C.
Each time the freezer door is open, the temperature increases 0.3°C.
To determine how many times the door fridge

can be opened for a 10.5°C increase in the temperature, divide: 10.5 ÷ 0.3
Divide whole numbers: 105 ÷ 3 = 35
Then: 10.5 ÷ 0.3 = 35
So, the door can be opened 35 times before the temperature increases to 5°C

14. To determine the mean change in temperature per hour, divide: (–15.4) ÷ 5.5 = –2.8
The mean change in temperature was –2.8°C per hour.

15. To determine the change in value of one share, I divide the change in value of all shares by the number of shares.
(–17.28) ÷ 54 Since the dividend and the divisor have different signs, the quotient is negative.
(–17.28) ÷ 54 = –0.32
So, the change in value of one share was –$0.32.

16. Explanations may vary. For example:

a) $\left(-\frac{2}{3}\right) \div \left(-\frac{2}{3}\right)$

Any number (except zero) divided by itself is 1.
So, the quotient is not less than $-\frac{1}{2}$.

b) $\frac{1}{3} \div \left(-\frac{2}{3}\right)$

Since the dividend and the divisor have different signs, the quotient is negative.
$\frac{1}{3}$ is one-half of $\frac{2}{3}$. So, the quotient is $-\frac{1}{2}$.

c) $\frac{5}{6} \div \left(-\frac{2}{3}\right)$

To predict, I first ignore the signs. Since $\frac{5}{6}$ is greater than $\frac{2}{3}$, or $\frac{4}{6}$, the quotient $\frac{5}{6} \div \frac{2}{3}$ is greater than 1. The quotient of a positive number and a negative number is negative. So, $\frac{5}{6} \div \left(-\frac{2}{3}\right)$ is less than –1, and, therefore, less than $-\frac{1}{2}$.

d) $\frac{1}{4} \div \left(-\frac{2}{3}\right)$

To predict, I first ignore the signs, then I use common denominators to compare the fractions.

$\frac{1}{4} = \frac{3}{12}$ and $\frac{2}{3} = \frac{8}{12}$

The quotient $\frac{1}{4} \div \frac{2}{3} = \frac{3}{12} \div \frac{8}{12} = \frac{3}{8}$, which is less than $\frac{1}{2}$. So, the quotient $\frac{1}{4} \div \left(-\frac{2}{3}\right)$, which is negative, is greater than $-\frac{1}{2}$.

17. Write a related division or multiplication statement to determine each missing number.

a) $\square \div 1.25 = -3.6$

$\square = (-3.6) \times 1.25$

$= -4.5$

So, the missing number is –4.5.

b) $\square \div \left(-\frac{3}{4}\right) = \frac{7}{8}$

$\square = \frac{7}{8} \times \left(-\frac{3}{4}\right)$

$= -\frac{21}{32}$

So, the missing number is $-\frac{21}{32}$.

c) (–0.5875) ÷ $\square$ = –0.25

$\square$ =(–0.5875) ÷ (–0.25)

Since the divisor and the dividend have the same sign, the quotient is positive.

$\square$ = 2.35

So, the missing number is 2.35.

d) $\frac{68}{15} \div \square = -\frac{4}{5}$

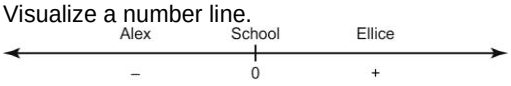
$\square = \frac{68}{15} \div \left(-\frac{4}{5}\right)$

$= \frac{^{17}\cancel{68}}{^{3}\cancel{15}} \times \left(-\frac{\cancel{5}^{1}}{\cancel{4}^{1}}\right)$

$= -\frac{17}{3}$

So, the missing number is $-\frac{17}{3}$.

19. a) Visualize a number line.



Since Ellice and Alex are running in opposite directions from school, we can represent these directions as positive and negative.
Ellice's average speed (in kilometres per minute): $1.3 \div 7.8 = 0.1\overline{6}$
An average speed of $0.1\overline{6}$ km/min indicates Ellice is running in the positive direction.
Convert 630 m to 0.630 km.
Alex's average speed (in kilometres per minute): $(-0.630) \div 4.2 = -0.15$
An average speed of –0.15 km/min indicates Alex is running in the negative direction.

b) Since the signs of the average speeds tell us in which direction each student is running, we ignore the signs when comparing speeds.
$0.1\overline{6} > 0.15$
So, Ellice has the greater average speed.

20. Answers will vary. For example:
For fractions:
I know that $\frac{3}{5}$ is $2\left(\frac{3}{10}\right)$, so $\frac{3}{10} \div \frac{3}{5} = \frac{1}{2}$ and $\left(-\frac{3}{10}\right) \div \frac{3}{5} = -\frac{1}{2}$

I know that $\frac{4}{5}$ is $3\left(\frac{4}{15}\right)$, so $\frac{4}{15} \div \frac{4}{5} = \frac{1}{3}$ and $\frac{4}{15} \div \left(-\frac{4}{5}\right) = -\frac{1}{3}$

I know that $\frac{5}{8} \times \frac{3}{5} = \frac{3}{8}$, so $\frac{3}{8} \div \frac{3}{5} = \frac{5}{8}$ and $\left(-\frac{3}{8}\right) \div \frac{3}{5} = -\frac{5}{8}$

For decimals:
I choose a quotient between –0.75 and –0.25 and use that as one factor in a multiplication statement.
For –0.27, I write: (–0.27) × 9.1 = –2.457, then I write a related division statement:
$(-2.457) \div 9.1 = -0.27$

For –0.55, I write: (–0.55) × 1.3 = –0.715, then I write a related division statement:
$(-0.715) \div 1.3 = -0.55$

For –0.6, I write: (–0.6) × (–2.5) = 1.5, then a related division statement is:
$1.5 \div (-2.5) = -0.6$

21. In part a, since both terms are negative, $-\frac{1}{2} + \left(-\frac{2}{3}\right)$ is negative.

In part b, write the subtraction statement $-\frac{1}{2} - \left(-\frac{2}{3}\right)$ as $-\frac{1}{2} + \frac{2}{3}$.
Since $\frac{2}{3}$ is greater than $\frac{1}{2}$, the sum is positive.

In part c, since the factors have the same sign, the product $\left(-\frac{1}{2}\right) \times \left(-\frac{2}{3}\right)$ is positive.

In part d, since the divisor and the dividend have the same sign, the quotient is positive.
To compare the answers in parts c and d:
Rewrite part d as a multiplication statement:
$\left(-\frac{1}{2}\right) \div \left(-\frac{2}{3}\right) = \left(-\frac{1}{2}\right) \times \left(-\frac{3}{2}\right)$;
Since $\frac{3}{2} > \frac{2}{3}$, $\left(-\frac{1}{2}\right) \times \left(-\frac{3}{2}\right) > \left(-\frac{1}{2}\right) \times \left(-\frac{2}{3}\right)$; so the answer in part d is greater than the answer in part c.

Finally, calculate the answers in part b and part d to see which is greater:
b) $-\frac{1}{2} - \left(-\frac{2}{3}\right) = -\frac{1}{2} + \frac{2}{3}$.
$= \frac{1}{6}$

d)
$\left(-\frac{1}{2}\right) \div \left(-\frac{2}{3}\right) = \left(-\frac{1}{2}\right) \times \left(-\frac{3}{2}\right)$
$= \frac{3}{4}$

Since $\frac{3}{4} > \frac{1}{6}$, part d has the greatest value.